

Claims

I claim:

1. A method of embedding auxiliary information within original data, the original data being divided into a series of groups, each group in the series characterized by a numerical value, the method comprising:
  - (a) investigating a first group to determine the presence of a local masking opportunity; and
  - (b) if the first group indicated the presence of a local masking opportunity, embedding data by setting the value of one or more groups in the neighborhood of the first group, including the first group, in accordance with the value of a portion of the auxiliary data, whereby allowing data to be embedded efficiently.
2. The method of claim 1 in which
  - (a) determining whether the first group represents a local masking opportunity includes examining the value of the first group and its relationship to a value of at least one other group near the first group; and
  - (b) embedding data by setting the value of one of the nearby groups includes setting a value dependent upon the value of the first group and on the value of the portion of auxiliary data.
3. The method of claim 1 in which
  - (a) determining whether a first group represents a local masking opportunity includes determining whether the first group
    - (i) exceeds a predetermined threshold;
    - (ii) is a peak; and
    - (iii) the second group value differs from the first group value by a predetermined amount;
  - and

(b) embedding data by setting the value of the second group such that the difference between the first and second group are set by the portion of auxiliary data.

5 4. The method of claim 1 in which

(a) determining whether a first group represents a local masking opportunity includes determining whether

10 (i) the first group exceeds a predetermined threshold;

(ii) the previous group did not exceed the predetermined threshold;

15 (iii) the change in slope from the previous to the following group is less than another predetermined value; and

(iv) the difference between the first and previous group is less than yet another user defined value; and

20 (b) embedding data by setting the value of the second group such that the change in slope using the previous two group values is set by the portion of auxiliary data.

5. The method of claim 1 in which

25 (a) determining whether a first group represents a local masking opportunity includes determining whether the first group exceeds a threshold; and

(b) embedding data by setting the value of the first group includes changing the value of one or more bits of the first group.

30 6. The method of claim 1 in which each group represents a value of the same quantity measured at a different frequency.

35 7. The method of claim 1 in which nearby groups includes groups within 50 groups sequentially of the first group.

8. The method of claim 2 in which the original data represents the scaling factors or frequency coefficients of bit-rate reduced data, such as MPEG data.
- 5 9. The method of claim 2 in which each group represents a sample of audio data.
10. A method of retrieving auxiliary information within original data, the original data being divided into a series of groups, each group in the series characterized by a numerical value, the method comprising:
- 10 (a) investigating a first group to determine the presence of a local masking opportunity; and
- (b) if the first group indicated the presence of a local masking opportunity, retrieving data by measuring the value one or more groups in the neighborhood of the first group, including the first group,
- 15 whereby allowing data to be retrieved efficiently.
- 20 11. The method of claim 10 in which
- (a) determining whether the first group represents a local masking opportunity includes examining the value of the first group and its relationship to a value of at least one other group near the first group; and
- 25 (b) retrieving data by setting the value of one of the nearby groups includes setting a value dependent upon the value of the first group and on the value of the portion of auxiliary data.
- 30 12. The method of claim 10 in which
- (a) determining whether a first group represents a local masking opportunity includes determining whether the first group
- (i) exceeds a predetermined threshold;
- 35 (ii) is a peak; and

- (iii) the second group value differs from the first group value by a predetermined amount; and
- (b) retrieving data by setting the value of the second group such that the difference between the first and second group are set by the portion of auxiliary data.
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13. The method of claim 10 in which
- (a) determining whether a first group represents a local masking opportunity includes determining whether
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- (i) the first group exceeds a predetermined threshold;
- (ii) the previous group did not exceed the predetermined threshold;
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- (iii) the change in slope from the previous to the following group is less than another predetermined value; and
- (iv) the difference between the first and previous group is less than yet another user defined value; and
- 20
- (b) retrieving data by setting the value of the second group such that the change in slope using the previous two group values is set by the portion of auxiliary data.
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14. The method of claim 10 in which
- (a) determining whether a first group represents a local masking opportunity includes determining whether the first group exceeds a threshold; and
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- (b) retrieving data by setting the value of the first group includes changing the value of one or more bits of the first group.
15. The method of claim 10 in which each group represents a value of the same quantity measured at a different frequency.
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16. The method of claim 10 in which nearby groups includes groups within 50 groups sequentially of the first group.
17. The method of claim 11 in which the original data represents the scaling factors or frequency coefficients of bit-rate reduced data, such as MPEG data.
18. The method of claim 11 in which each group represents a sample of audio.
19. An apparatus for performing the described data embedding or retrieving process comprising of
- (a) a logic processor; and
  - (b) a storage unit,
- whereby the logical processor and storage unit can perform the described process.
20. The apparatus of claim 19 wherein the logic processor is digital processor and the storage unit is digital memory.
21. The apparatus of claim 19 wherein the logic processor and the storage unit consists of a combination of analog and digital circuitry.
22. The apparatus of claim 19 used to embed auxiliary information wherein the logic processor and storage unit include
- (a) a comparer device for comparing a group value in the series with a predetermined data and with at least one nearby group value to determine whether the group value represents a local masking opportunity;
  - (b) data writer for storing the original data and embedded data onto a storage media, the data writer changing a group value of the original data in the vicinity of the local masking opportunity to embed auxiliary data in the original data to produce combined data, the local masking

opportunity reducing the likelihood of perception of the changed value when the combined data is presented to the user; and

5 (c) said comparer determining additional local masking opportunities and the data writer changing corresponding group values in the vicinity of the additional local masking opportunities until all the auxiliary data is embedded in the original data or until no additional local masking  
10 opportunities are located or required.

23. The apparatus of claim 19 used to retrieve auxiliary information wherein the logic processor and storage unit include

(a) a comparer device for comparing a group value in  
15 the series with a predetermined data and with at least one nearby group value to determine whether the group value represents a local masking opportunity;

(b) said comparer providing the auxiliary data from  
20 the local masking opportunity; and

(c) said comparer determining additional local masking opportunities and auxiliary information data bits

whereby the apparatus is efficient.

25 24. A method of bypassing removal of embedded data during digital bit-rate reduction (i.e. compression) which includes using separate data embedding techniques for non-compressed and compressed data.

30 25. The method of claim 24 in which the auxiliary information is not lost during the compression (a.k.a. encoding) by

(a) retrieving the auxiliary information from the non-compressed data;

(b) compressing the combined data; and

(c) re-embedding the auxiliary information using an appropriate technique in the compressed data, whereby the compressed data still has the auxiliary information embedded.

- 5 26. The method of claim 24 in which the auxiliary information is not lost during the decompression (a.k.a. decoding) by
- 10 (a) retrieving the auxiliary information from the compressed data using an appropriate technique;
- (b) decompressing the compressed information; and
- (c) embedding the auxiliary information in the non-compressed data,
- whereby the non-compressed data still has the auxiliary information embedded.

- 15 27. A method of preventing unauthorized copying of audio data files, the audio data file being divided into a series of samples, each sample in the series characterized by a numerical value, the method comprising:
- 20 (a) determining whether a first sample represents a local masking opportunity by examining the value of the first sample and values of at least one other sample near the first sample;
- 25 (b) if the first sample represents a local masking opportunity, embedding a portion of unauthorized copy prevention data by setting the value of one of the nearby groups in accordance with the value of a portion of the copy prevention data, the local masking opportunity allowing the portion of
- 30 the unauthorized copy prevention data to be embedded with minimal perception by a user of the audio file;
- (c) locating additional local masking opportunities to embed additional unauthorized copy prevention
- 35 data within the audio data file; and

(d) upon attempting to copy the audio data,  
verifying whether the combined data includes copy  
prevention information and, if so, preventing a  
copy from being produced.

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